INSTALLATION INSTRUCTION MANUAL

JOHNSON VIKING MATCHSTICK ANTENNA SYSTEM

E. F. JOHNSON COMPANY, WASECA, MINNESOTA, U. S. A.

STANDARD WARRANTY

Adopted and recommended by the

Radio and Television Manufacturers Association

The E. F. Johnson Company warrants each new radio product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service disclosed such defect, provided the unit is delivered by the owner to us or to our authorized radio dealer or wholesaler from whom purchased, intact, for our examination, with all transportation charges prepaid to our factory, within ninety days from the date of sale to original purchaser and provided that such examination disclosed in our judgment that it is thus defective.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products.

MAINTENANCE OF THE MATCHSTICK

Since the Matchstick has a number of moving parts and contacts, a reasonable amount of maintenance will insure trouble free operation. Although the equipment is completely inspected and lubricated before leaving the factory, a thorough inspection should be made of all parts as soon as they have been unpacked to determine any damage caused during transit.

The following maintenance should be performed twice a year or more often in areas of heavy industrial contaminated atmosphere or areas where sand or dust storms occur.

1. Motor gears and bearings - Remove any external contaminated grease on gears and replace with a light grease such as Standard Oil Company Lithium Multipurpose grease (Lithium Soft in northern installations).

   A light machine oil should be put in the oil holes on each side of the motor.

2. Switch bearings - Place a few drops of a light machine oil on the C washer attached to the 3 wafer switch shaft and the single antenna switch shaft.

3. Switch index - Clean any contaminated grease from the two index rollers, index gear and index arm pivots. Replace grease with the light grease used on motor bearings.

4. Antenna switch - Clean stationary and rotating contacts and place a very light film of Vaseline over each contact. This film can be put on by rubbing some Vaseline between two fingers and then applying to the contacts. Place a similar film of lubrication on the spring contact to the moving arm.

5. Wafer switch contacts - Clean contacts with a small brush dipped in a cleaner fluid. A cigarette lighter fluid will serve as a good cleaner to clean contacts or remove contaminated grease.

6. Check all screws and nuts and tighten those that are loose.

Johnson MATCHSTICK Antenna System

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JOHNSON MATCHSTICK ANTENNA SYSTEM

INTRODUCTION

1. GENERAL DESCRIPTION

The Johnson MATCHSTICK is an engineered antenna system designed to operate on all amateur frequency bands from 3.5 through 30 megacycles with transmitter inputs up to 1000 watts. The radiation pattern is circular or 360° in scope with the radiation concentrated at a low vertical angle.

The antenna system consists of a vertical radiator, a preadjusted matching network, and a remotely controlled band switching system which automatically seeks the frequency set on the control unit. The network is preadjusted to match the radiator to a 52 ohm coaxial transmission line with a SWR of less than 2 of any of the frequency bands. Some suppression of the TVI and harmonic radiation is secured by the network and its shielded enclosure.

The Johnson MATCHSTICK is ideally adaptable to locations where space is restricted, neatness of appearance is desired, ease of installation is a requirement, and efficient all band radiation is essential.

2. TERMINOLOGY

The terminology of "vertical antenna" and "ground plane antenna" has often been indiscriminately given to a radiator which is in a vertical position. The term "vertical antenna" is applied to a vertical radiator whose base is spaced a few inches away from and insulated from the ground with the ground radials either lying on or buried in the ground. A "ground plane" antenna is a vertical radiator whose base and ground radials are located an appreciable distance above the ground. Thus the MATCHSTICK antenna system mounted on the ground would be correctly called a vertical antenna while a roof top installation of the MATCHSTICK should be referred to as a ground plane antenna.

The term "radiator" is used, in the text of these instructions, to refer to the vertical aluminum tubing.

3. BASIC THEORY

a. Radiation Pattern

The vertical or ground plane antenna is basically an unbalanced antenna which is fed power at the ground or ground plane end. The radiation is vertically polarized and is circular (360°) around the axis of the radiator if viewed from the top as shown in Figure 1. This circular pattern may be deformed by metallic objects (drain pipes, wires, masts, etc.) in the near vicinity. To avoid pattern distortion and absorption of radiated energy, the MATCHSTICK should be installed in the clearest space available.

Figure 1
Horizontal Pattern

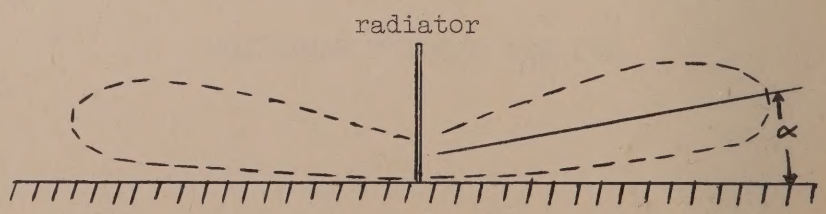


Figure 2
Vertical Angle of Radiation

The maximum radiated power of the vertical radiator is at a low angle in respect to the earth for radiator lengths up to 5/8 of a wavelength, as shown in Figure 2. The low angle of radiation is an advantage in working DX and stations beyond 400 -- 500 miles and stations within ground wave range. However, the signal strength of a vertical radiator is not quite as great as a horizontal antenna for distances up to about 400 miles -- the exact range being dependent upon propagation conditions and frequency.

b. Radiator Dimensions and Impedance

The radiator length is the largest factor determining the base or input impedance of a radiator. For a quarter wave antenna this impedance is about 36 +j 40 ohms and increases both in resistance and inductive reactance to a maximum value for radiators slightly below one half wave length. Increasing the diameter of the radiator will lower the reactance and make the radiator more broadband.

Metal objects such as roofs, drain pipes, telephone or power lines will modify the input impedance if they are too close to the radiator. A poor ground system will also modify the impedance by adding ground loss resistance to the input resistance of the radiator.

c. Ground System

When an antenna is operated with one end near ground, energy radiated toward the ground is reflected and becomes a part of the energy radiated to a distant point. A ground system of wires extending radially from the base of the antenna is used to improve the ground (reduce ground losses) for vertical antennas and to bring the "ground" up to the base for ground plane antennas.

d. Impedance Matching

An impedance matching system is used when the impedances of the transmission line and the radiator are not similar. When the radiator length is adjusted so the input impedance is very close to that of the transmission line, the two may be connected directly.

If the impedances are not matched over a frequency band, some power will be reflected back toward the transmitter causing standing waves on the line. From a practical standpoint, a mismatch of impedances sufficient to give a standing wave ratio (SWR) of 2 will increase the loss in the line by only a small amount. As an example, a 100 foot length of RG8/U coaxial cable has a 1.0 db loss with a SWR=1 at 30 megacycles and 1.19 db loss with a SWR=2 at the same frequency. This additional .19 db loss would be difficult to detect on a receiver S meter where each division is approximately 6 db. Although the loss caused by a SWR of 2 is small, some limitation must be established to avoid high voltage points on the line and for satisfactory operation with associated equipment such as low pass filters. A SWR of 2 is usually set as the maximum limit although this value may be exceeded slightly at lower power levels.

MATCHBOX ANTENNA SYSTEM

1. RADIATOR

The vertical radiator consists of three sections of 2" diameter aluminum tubing of 8 feet, 2 feet and 24.75 feet lengths connected together with steatite insulators as shown in Figure 4. Special relays are connected across the steatite insulators to connect or remove the tubing sections as required by the operating frequency as shown below:

Frequency Band	Radiator Physical	Length Wavelength	Sections Used
3.5	35 ft.	.128	All Sections
7.0	35	.256	All Sections
14.0	35	.515	All Sections
21.0	10	.222	Top Section Disconnected
26.96	8	.228	Top & Middle Sections Disconnected
28.0	8	.236	Top & Middle Sections Disconnected

With the exception of the 3.5 and 14.0 mcs radiators, the radiator lengths have been determined to give an impedance such that the coaxial transmission line can be connected directly to the antenna with an SWR of 2 or less. The .128 wavelength radiator for 3.5 mcs. band and the 14 mcs. band .515 wavelength radiator require a matching network.

Nylon cord is used for guying since it is an excellent insulator and avoids any possibility of reradiation such as occurs with improperly insulated guy wires. Nylon guys also remove the noise of guy wire "singing" which is particularily annoying on roof installations.

2. GROUND SYSTEM

No wire is furnished for the ground system radials since this item is usually available from local sources or is present in the average "junk box". The copper wire may be any size from 16 to 12 gauge and preferably should be enameled. Twelve wires should extend radially at equal angles from the base of the radiator (see installation section for details).

3. CONTROL SYSTEM AND CONTROL UNIT

The Johnson MATCHSTICK system will automatically tune to the desired frequency which is selected on the control unit by the operator at the operating position. The operator need merely set the frequency dial to the desired frequency and an electrical positioning motor located at the base of the antenna will tune the system.

Switching and matching of the coaxial line and radiator is accomplished by switch wafers SW3, SW4 and inductor L1 as shown in Figure 11. Both switch wafers are turned by motor, B1. On the 40, 15, 11 and 10 meter bands, the coaxial line is switched directly to the radiator since the radiator on each of these bands is approximately one quarter wavelength long. On 20 meters, two positions are provided on the switches and inductor for operation near 14.1 mcs. (14.00 - 14.15) and 14.2 mcs. (14.15 - 14.35). Five separate positions are provided on the switches and inductor for operation of the antenna system over the 3.5 to 4.0 mcs. band.

The length of the radiator is changed by two relays installed on the radiator. The operation of the relays is controlled from the switch wafer, SW3B, which is automatically turned by the motor (B1) to the frequency selected at the control unit, (see Figure 11). Filters consisting of chokes and capacitors are used in the control wire circuits for R.F. protection of the relays, switch wafer SW3B and the control unit cable.

A rectifier located in the control unit provides d.c. voltage to operate the two radiator relays thus avoiding any chance of relay chatter which could create objectionable noise after traveling down the radiator to the metal base plate. Since one side of the household a.c. power line is grounded, an isolation transformer (T1) is provided as a precaution against the operator coming in contact with 115 V.A.C. between the ground system or radiator and the a.c. power leads in the matching box. Overload protection is provided by fuse, F1, in the primary side of the isolation transformer.

The selection of the proper position on switch SW3 and SW4 for each frequency is controlled by the sequencing of the contacts between SW2 and SW3A, Figure 11. The frequency or band to be selected is set on the control unit switch SW2 which controls the power to the motor B1 through the other sequence switch, SW3A, which is driven by the motor. Thus the motor will continue to turn until an open position is reached on the SW2-SW3A combination. Regardless of which way the control unit selector dial is turned or the number of steps it is moved, the motor will continue to turn until the SW3-SW4 switches are in the proper position for the frequency selected.

The indicator lamp, I1, which has part of the motor current flowing through it, will glow whenever the motor is set in motion by changing the position of the frequency selector switch, SW2. The lamp will continue to glow until the motor has reached the proper position of SW3-SW4 for the frequency selected and has stopped. Thus the operator may select a frequency on the control unit and divert his attention to receiver or transmitter adjustments while the antenna system automatically completes the switching as indicated when the lamp becomes extinguished. The maximum switching time is about 30 seconds.

4. CABLES

No transmission line or six wire control unit cable is provided since these items can be more readily secured to proper length locally or are already available at the station. The transmission line may be any 52 ohm impedance coaxial line (such as RG8/U) which has a power rating equal to that of the transmitter output. The control cable may be made up of six lengths of plastic covered no. 20 or 22 ga. copper wire loosely twisted together or a covered cable of six insulated wires of this gauge may be purchased (such as Belden #8742). Adequate wire is furnished for the construction of control cables from the matching box to the two relays.

ASSEMBLY OF THE MATCHSTICK

The following step-by-step procedure is presented as a guide in the assembly of the radiator and its guys, relays and control wires. The radiator should be assembled on level ground, a concrete garage floor, a flat roof, or other flat surface.

1. TOP RADIATOR SECTION

This section consists of two 12'4" lengths of aluminum tubing spliced together by a 12" length of split tubing as shown in Figure 3.

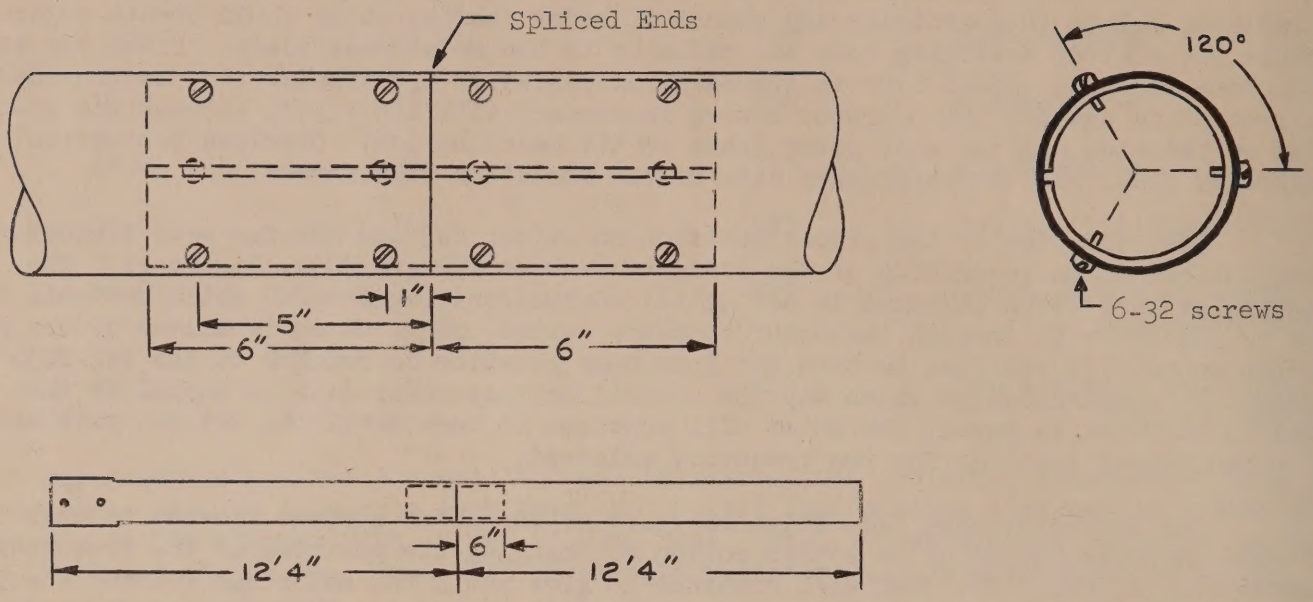


Figure 3

The split tubing splice should be squeezed together until the two edges touch. This can be done by looping a few turns of copperweld or steel wire around the splice, wrapping the ends together and then by inserting a screw driver under one of the turns, twisting the wire around itself in the manner of a tourniquet. The compressed splice should be inserted 6" into the tubing at the end without cross holes. Drill a hole (use No. 37 drill furnished) through the tubing and splice one inch from the end of the tubing and opposite the slit in the splice tube and insert a 6-32 self tapping screw which should be tightened. Push one end of the remaining 12'4" length of tubing over the rear of the exposed splice until the two ends are tightly butted against each other.

With the tubing laying on level ground or floor, drill the remaining holes (use No. 37 drill) on each side of the splice as shown in Figure 3 and insert and tighten 6-32 self tapping screws.

2. BOTTOM AND MIDDLE RADIATOR SECTIONS

One of the steatite insulators should be inserted into the swaged end of the top section so the hole through the tubing and insulator are aligned (see Figure 4). The end of the 2' section of tubing can now be fitted to the other end of the insulator so the holes are aligned. If any difficulty is experienced in fitting the insulator and tubing together, remove any burrs present at the end of the tubing and wipe the inside of the tubing clean. A very light coating of Vaseline over the area of the insulator to be inserted in the tubing will be of assistance. Under no circumstances should the end of the tubing be hammered to force the tubing over the insulator. If a board is placed at the end of the tubing, light hammering may be done (this avoids burring or collapsing of the tubing).

In the same manner as described above, the remaining insulator should be inserted into the lower swaged end of the 2' section of tubing and the bottom 8' section of tubing should be connected to the bottom end of this insulator.

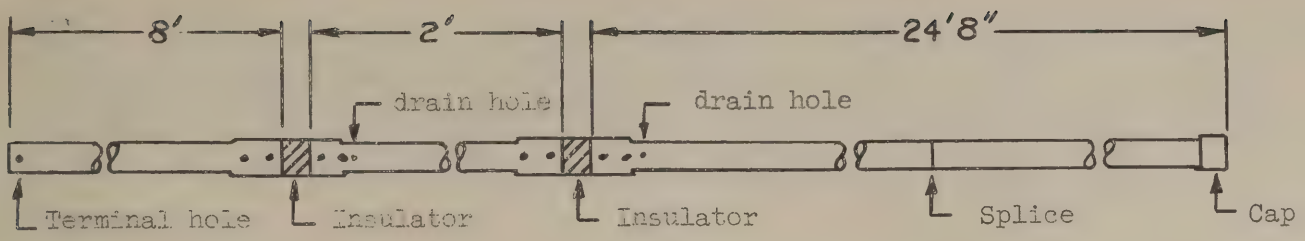


Figure 4

3. RADIATOR GUYS

The 200' of nylon cord furnished for guys should be separated into three lengths each of 39' and three lengths each of 27'8" (see Installation 1,b). The nylon should be cut with the edge of a hot soldering iron which will prevent unraveling of the nylon strands.

One end of each of the 6 nylon lengths should be connected to the rope thimbles as shown in Figure 5. The cord should be tied with a tight double hitch knot with about 2" of free end left beyond the knot. The free end can be tightly wrapped against the long cord with lacing cord or electric tape.

Figure 5

The two sets of 3-guy clamps should be installed on the radiator with one set 8' from the top end and the other set 20' from the top end (see Figure 10). The clamps should be assembled as shown in Figure 6. Each of the sections should be connected together with 1" long 1/4-20 screws, 11/32" long spacer, guy thimble with guy cord assembled, 1/4" lockwasher and 1/4-20 hex nut. After the 1/4-20 screws are tightened so the clamps are securely against the radiator tubing, drill a hole (No. 37 drill) into the tubing thru the hole in the center of each clamp and insert a self tapping 6-32 screw and tighten. The three 39' guys should be installed nearest the top of the radiator.

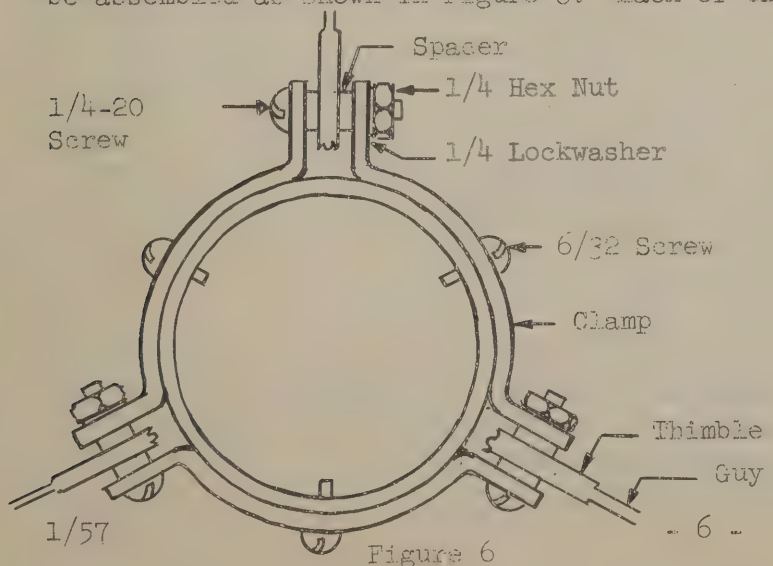


Figure 6

4. RADIATOR CAP COVER

This cover consists of an aluminum cup which has an inside diameter slightly larger that the aluminum tubing. The edge of cup should be bent slightly inward at four places equally spaced around the cup by using about 1/8" of the end of a long nose pliers. The bends should be just enough so the cover will fit tightly over the top end of the radiator tubing.

5. RADIATOR RELAY BOXES AND CONTROL WIRES

Cut a 28" length of the brown plastic covered wire and a 28" length of the orange plastic covered wire from the 140" rolls of wire. Twist the two 28" lengths of wire together at about 1 turn per inch, strip 5/16" of plastic off all ends and solder #6 solder lugs on the ends. In like manner, twist the three (brown, orange and yellow) 112" leads together, strip all ends 5/16" but only solder three #6 solder terminals at one end of the leads. Be sure the wires are looped through the hole in the soldering terminals at least once and a good solder joint is made.

Connect the relays together using the brown and orange 28" leads allowing 19" between the centers of the cable clamps (see Figure 11). The two wires should be looped through the cable clamp and twisted once around before connecting to the terminals, Figure 7. The internal tooth lockwasher must be placed between the solder lug and the outside hex nut.

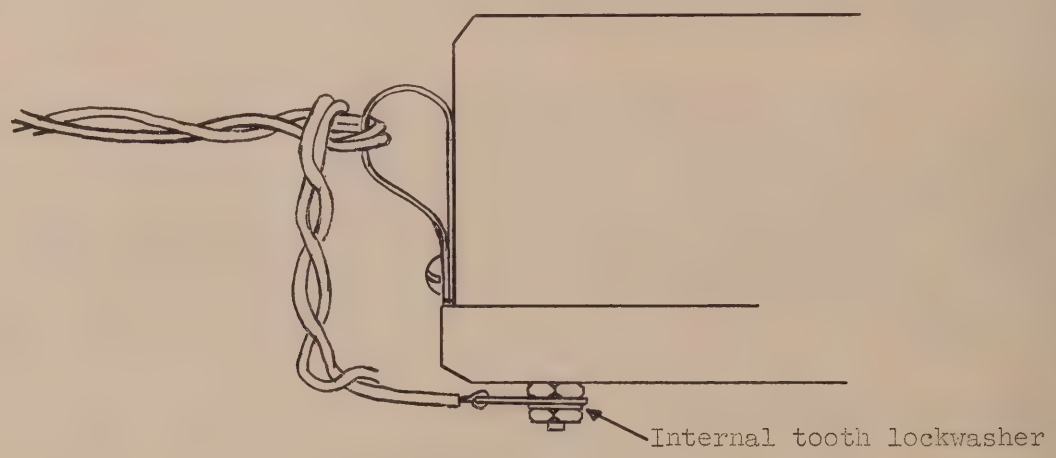


Figure 7

In a similar manner, connect the three wire cable (brown, orange and yellow) to the three terminals at the end of the relay box. Be sure the orange cable wire connects to the orange lead inside the relay box and the yellow lead connects to the terminal next to it. The three wire cables should be looped through the cable clamp as described previously.

The relay boxes can now be bolted across each of the insulators by using 2 3/4" 10-32 screws with 10-32 internal tooth washers under the screw heads. Tighten the screws securely. The relay between the long top section and the 2' section of tubing is the one with only two wires connected to it.

6. RADIATOR TERMINAL AND DRAIN HOLES

The terminal hole on the radiator is located 3/4" from the open end (bottom) of the 8' section (Figure 4). The 5/8" 10-32 terminal screw should have the screw head and an internal tooth lockwasher inside the tube and, outside the tubing, an internal tooth lockwasher, hex nut, two internal tooth lockwashers and another hex nut. Tighten the hex nut nearest the tubing securely.

Drill a single hole (No. 37 drill) in the top and middle section tubing just above the top end of the insulators in the tubing. The hole should be located 3 1/32" from the end of the tubing and should be drilled slowly so the drill is not damaged in case the drill comes against the insulator. These two holes will serve as drain holes for condensed moisture in the top and middle sections.

INSTALLATION

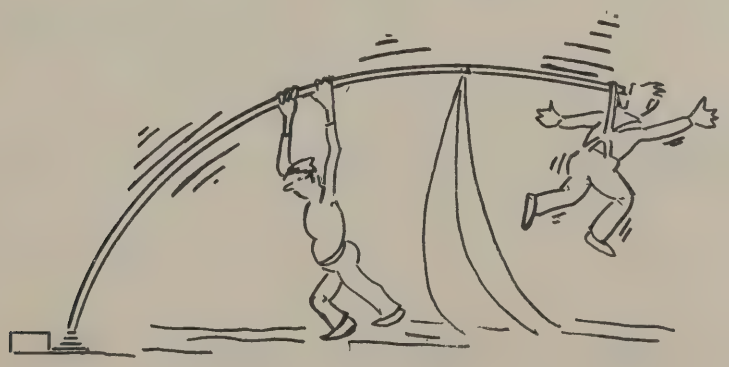
1. ROOF INSTALLATION

The choice of location on a roof will depend upon space available; location of power lines, TV antennas etc, and the proximity to the transmitter-receiver location. The radiator should be located so the guy cord connections to the roof are preferably 16 feet or more from the radiator and the three guys can be equally spaced 120° around the radiator.

a. Base Mount

After the location has been decided upon, the pitch of the roof must be determined so a wood mounting base can be constructed for the radiator-network base plate. The base may consist of two 1" boards 12" long and about 12" wide. If the pitch of the roof is large, 4 or 8 pieces of 1" board 8" long and 3" wide will be required in addition to the two large boards. Some examples of construction of wooden bases for different roofs are shown in Figure 8. These bases are "self-anchoring" (except in one case) which avoids driving nails or screws through the roof.

When the wood base (roof mount) has been fitted to the roof, the antenna base may be mounted. The four mounting brackets should be connected to the underside of the antenna base by means of 3/4" long 1/4-20 screws using the following sequence: screw head, bracket, radiator base, 1/4 lockwasher, 1/4 hex nut (tighten securely), 1/4 lockwasher and one 1/4 hex nut. The portion of the 1/4-20 screw extending out from the radiator base will be used for ground radial termination. If the base brackets do not contact the wood roof mount, one or two small boards should be placed under each bracket and securely nailed to the base board. Any small space between the bracket and wooden base may be adjusted be bending the bracket slightly. After the brackets have been fitted to the wooden base, they should be secured by using lag screws the same length as the thickness of the wood under the bracket. The assembled radiator base plate and wooden base can be put in place on the roof. In most installations, it may not be necessary to nail the wooden base to the roof as the downward pull exerted on the radiator by the guys will be enough to keep the base in place.



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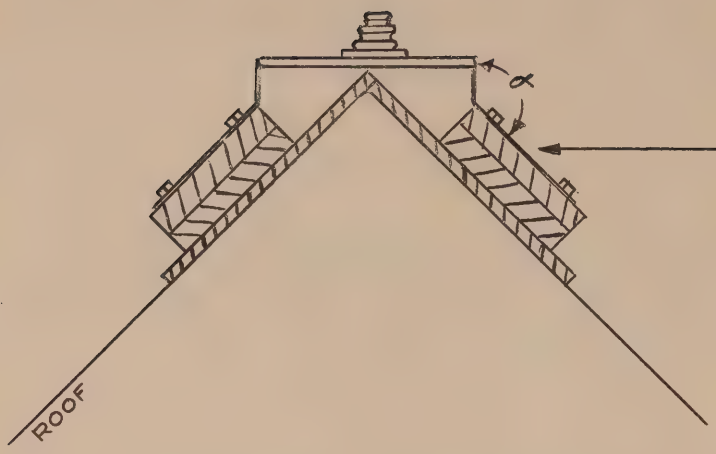
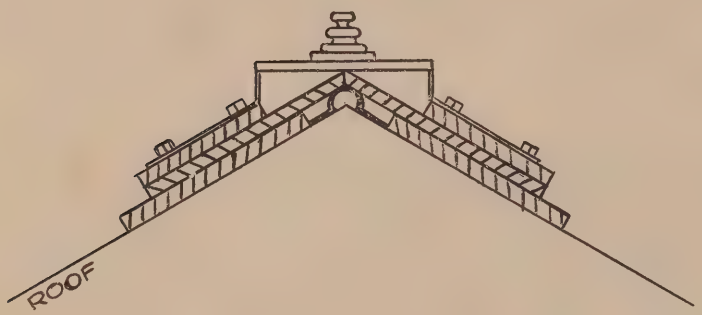
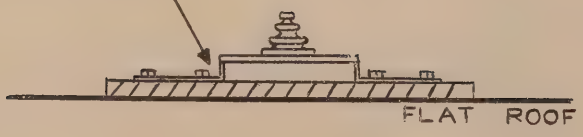
BEFORE ERECTION



For flatter roofs, bend brackets tc smaller angle (α) and dispense with extra board under bracket





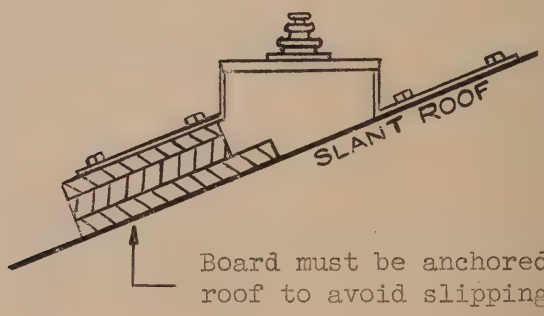


Figure 8

b. Guy Anchors

The guy lines should be securely fastened to the house with large screw eyes that have a smooth surface for the nylon cord. If the distance to the guy anchor is longer than the nylon cord, a screw eye turnbuckle may be used between the cord with wire making up the rest of the distance to the guy anchor. The three guy anchors should be located preferably 16' or more from the radiator base and spaced 120° around the base.

c. Erecting Radiator

When the radiator base assembly and three guy anchors have been installed, the radiator may be erected. The radiator should be laid parallel to the roof peak with the bottom resting next to the base insulator and the relay boxes facing upward. Arrange the loose guy ropes so they lay in the direction of their anchors. Have one person hold the base of the radiator down while another person walks the radiator up into the vertical position at which time it may be raised upward slightly and slipped over the top of the base insulator. The top guys should be secured to their anchors and adjustments made to put the radiator in a true vertical position. The lower guys may be secured to the anchors and adjusted to remove any bend in the lower part of the radiator. Be sure all guys are pulled quite tight and securely fastened -- some slack in the cord may develop as the nylon strands tighten on each other and guy readjustments may have to be made later on.

d. Radials

Ten 35' lengths of 16 to 12 gauge copper wire and two lengths (long enough to reach to the ground) of 12 gauage wire should be cut, stretched, and 1/4" solder lugs (supplied with antenna) soldered on one end of each radial. Three radials should be connected to each of the 4 bolts holding the base to the brackets, Figure 10. The radials should be spaced out from the base at as even an angle as practical and extend as close as possible to the end of the roof with the overage bent back up the roof at an angle from the original wire, Figure 10. All radials should be tacked or stapled down at least at the bend and the end. The two long radials should go to the actual ground and connect to ground rods driven in the earth to provide lightening protection.

e. Coaxial and Control Cables

The 52 ohm coaxial line should be secured to the roof mount and connected to the terminal on the network box. The coaxial line should be placed on the roof between two radials and should not be close to either radial - if necessary, spread the two radials.

The three wire control cable from the bottom relay should pass through the large hole of the TV stand-off insulator which should be adjusted so it is at 90° with the side of the box as shown in Figure 9.

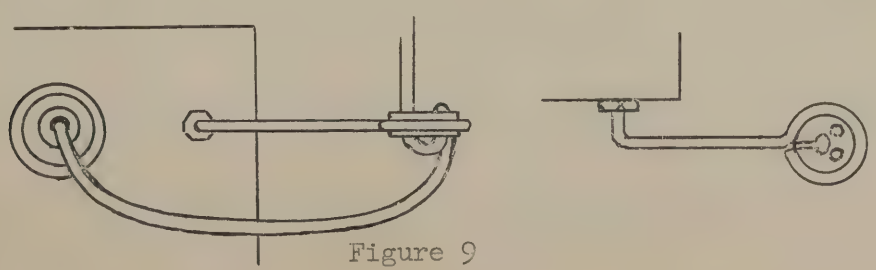


Figure 9

After the wire has been passed thru the large hole, it should be looped upward and back downward through the two smaller holes with the wires between the bottom relay and TV insulator pulled tight. The wires should then go through the hole in the feed through insulator and the ends connected to the 3 terminals having the same color wire which is connected to the other end of the chokes (see schematic diagram Figure 11). A small loop should be left between the TV standoff and the feed through insulator as a water drip point. Wrap electrical rubber tape around the three leads, where they enter the insulator, to seal the hole.

The six wire control cable from the control unit should enter the matching box through the rubber grommet and should connect to the terminal boards in the control unit and matching box as shown in the schematic diagram, Figure 11. The cable does not necessarily have to have the color coding of the circuit leads at the terminal board - the important thing is for the same wire to connect the same color circuit leads together or the same numbered terminals together. In both the control unit and matching box, the number 1 terminal is on the left side when facing the terminal board. The control cable should not run close to any of the ground radials or the coaxial line to guard against excessive R.F. voltages.

f. Static Drain and Protective Choke

The matching box has a R.F. choke across the coaxial line input termination for protection against high voltage on the inner conductor and to provide a means of draining static voltage off the radiator.

If the transmitter uses a pi network in the final stage, the choke provides protection against the high voltage being applied to the inner conductor of the coaxial line in event the blocking capacitor fails. On 40, 15, 11 and 10 meters, the radiator does not have a d.c. connection to ground and the high voltage on the coaxial line conductor could be extremely dangerous both at roof and ground antenna installations.

2. GROUND INSTALLATION

The ground installation is very similar to the roof installation except for the location of the base in close proximity to the ground with the radials buried in the ground.

The radiator base brackets should be bent to a 90° angle so they can be fastened to a flat surface which can be a concrete slab, a square piece of metal or a square piece of wood. The mounting surface should be about 4" above the ground level so the matching box has some space underneath it, to avoid rain spatter, seepage, or snow.

The ground radials are laid out the same as those on the roof except for the two long radials that go to the grounding rods. Since the space restrictions may not be as confining as on the roof, the radial lengths may, if desired, be increased to extend to the property lot line. All radials should be buried approximately 2" to 3" for better conduction of the ground currents and to remove the physical hazard of people tripping over them. Because of this latter reason, it is also recommended that the coaxial transmission line and control cable be buried beneath the ground surface.

The guy anchoring will be the same as the roof installation except that reasonably long wooden or metal stakes driven into the ground are used instead of the screweyes on the house.

If the antenna is to be used with a high power transmitter, a small wooden picket

fence around the antenna base is recommended and especially so if children are apt to be in the vicinity of the antenna. The fence will prevent anyone from coming in contact with the radiator and incurring a R.F. burn in event the transmitter is on and also to prevent tampering with the antenna equipment.

CONTROL UNIT

The control unit is housed in a small metal cabinet with a frequency selector switch, power switch and indicator bulb on the front. The terminal board for the 6 wire control cable from the matching box,and the power cord, are located at the rear of the cabinet. The schematic diagram of the control unit is shown on Figure 11.

Installation of the control unit consists of connecting the 6 wire cable to the terminal board (No. 1 lead is on the left when facing the terminal board) so the same wire in the cable connects the same colored or numbered wire terminals in the matching box and control unit. A good ground lead should be connected to the left band screw holding the terminal strip. The power plug should be inserted in a 115 volt 50-60 cycle outlet.

MATCHSTICK OPERATION

When the MATCHSTICK has been completely installed, place the power toggle switch on the control unit in the ON position. The selector switch knob may be turned to the nearest frequency or the band indicated around the selector knob. The motor will then start to turn (as indicated by the glow of the indicator bulb) and will continue to run until the proper radiator and network combination has been selected at which time the motor will shut off automatically (indicator bulb extinguished).

The 28 mcs. position on the control unit is used for both 10 and 11 meter operation while the two OFF positions underneath the selector knob are those in which the radiator is not connected to the network or to the coaxial line. The selector switch should be placed in the OFF position during electrical storms.

NETWORK ADJUSTMENT

The networks which are used on the 80 and 20 meter bands have been adjusted at the factory so that the SWR over either band is less than 2. On the other bands, the coaxial line is connected directly to radiator which length has been selected so that the line SWR is 2 or less over these bands.

There may be unusual situations where the SWR may exceed 2 on one or more bands due to metalic roofs, nearby wires or masts. Adjustments can be made by using an SWR bridge (such as Johnson SWR Bridge 250-24) at the coaxial input of the matching box. Both the inner and outside conductor connections between the bridge and matchbox must be very short - not much more than 1" to 1 1/2". On 80 and 20 meters, the antenna tap should be adjusted first for lowest SWR and then the input tap should be adjusted for further reduction of the SWR reading. The only method of adjustment on 40, 15, 11 and 10 meters would be the insertion of a small amount of inductive reactance (small inductor) or a small capacitive reactance (large mica capacity) in individual leads between the appropriate terminals on switches SW3C and SW4, Figure 11. Both the inductor and capacitor should be capable of carrying the antenna current.

OPERATION CHECK:

1. The relay operation may be checked by the following procedure:

   a. Both relays are open at 28 mcs. position on control unit.

b. Bottom relay closed and top relay open at 15 meter position on control unit.

c. Both relays closed on 14.2 to 3.5 mcs positions on the control unit.

d. Failure of one or both relays fail to operate - caused by

1. Cable from control unit to matching box not connected properly.

2. Primary voltage off, defective fuse or rectifier.

3. Open chokes.

4. Incorrect connections in relay control cable.

2. Loading difficulties may be encountered from the following causes - some of which may present a high reflected impedance at the transmitter end of the coaxial line:

a. Transmitter output not capable of working into a 50 ohm load.

b. Antenna system not on the same band as the transmitter.

c. Tap leads on the inductor are shorted against each other or to the inductor.

d. Ground system is completely or partially open.

e. Close proximity of metallic wires, pipes or roof has materially changed impedance of radiator.

f. Coaxial line or connections to terminal plugs defective.

3. Excessive R.F. voltage on the 6 wire control cable can be caused, especially at the roof installation, by the following:

1. Cable too close to a radial or the coaxial line.

2. Unsatisfactory ground on control unit.

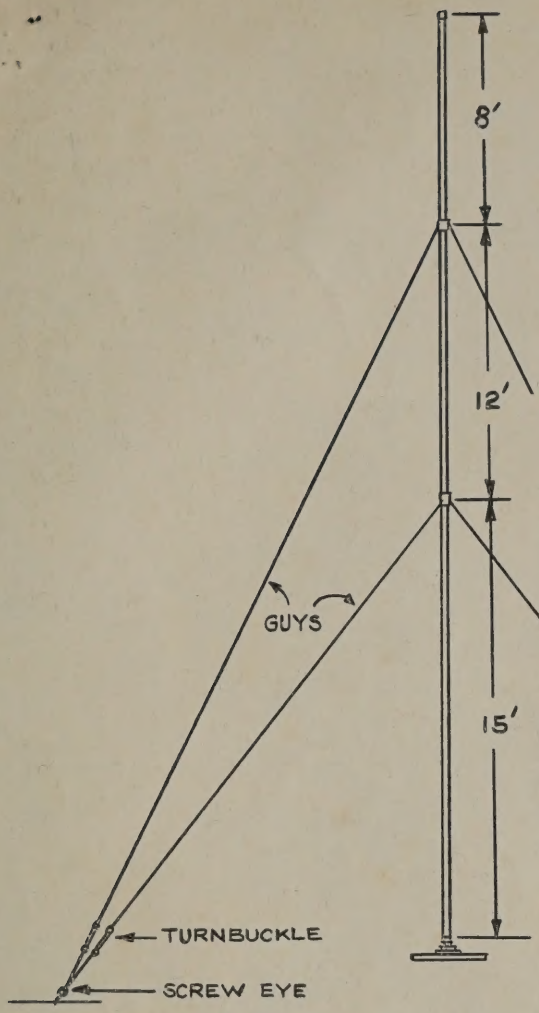
3. Defective disc by-pass capacitors in control unit or matching box.

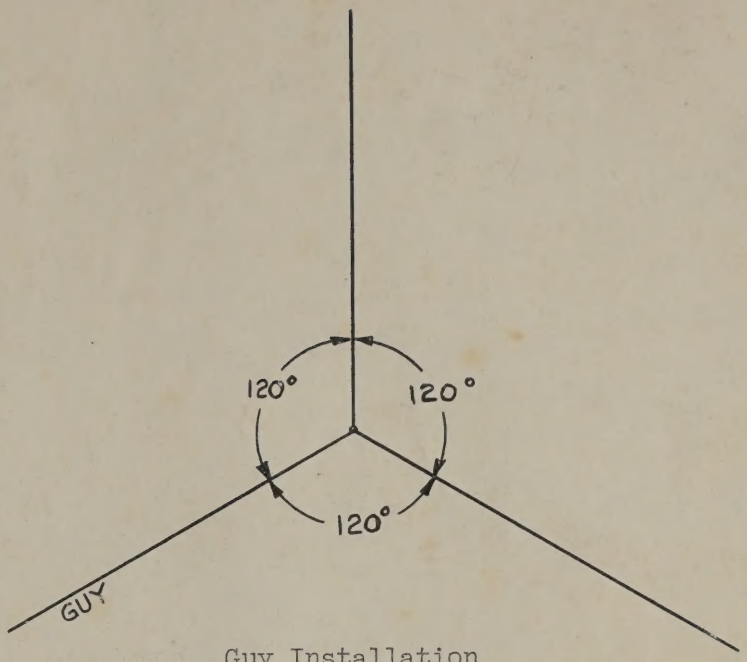
4. Ground at transmitter not effective.

TVI AND SPURIOUS RADIATION

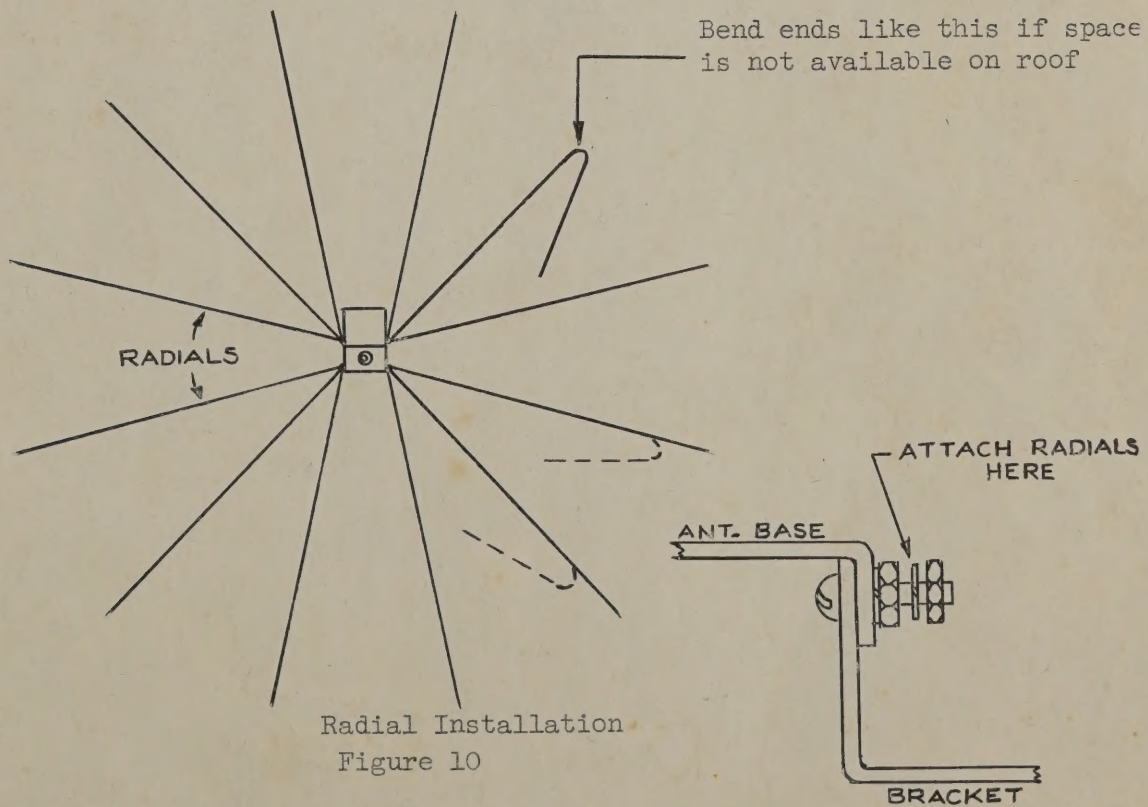
The MATCHSTICK antenna will have some discrimination against harmonic radiation because, as a tuned antenna, it will absorb maximum power only at the frequencies where a match between the coaxial line and radiator is effective. However, like any other antenna system, a loose connection or defective part which permits an arc to form will cause TVI and spurious radiation as well as erratic operation or performace of the antenna system. Interference caused by an improperly adjusted or shielded transmitter will have to be corrected at the transmitter.

Because of the higher field intensity in the vicinity of the radiator, a voltage may be introduced in metallic objects such as roof drain pipes, TV antenna masts etc which, if they have a loose connection, will also cause a spurious radiation to take place. These non-linear harmonic producing sources must be corrected at their origin.

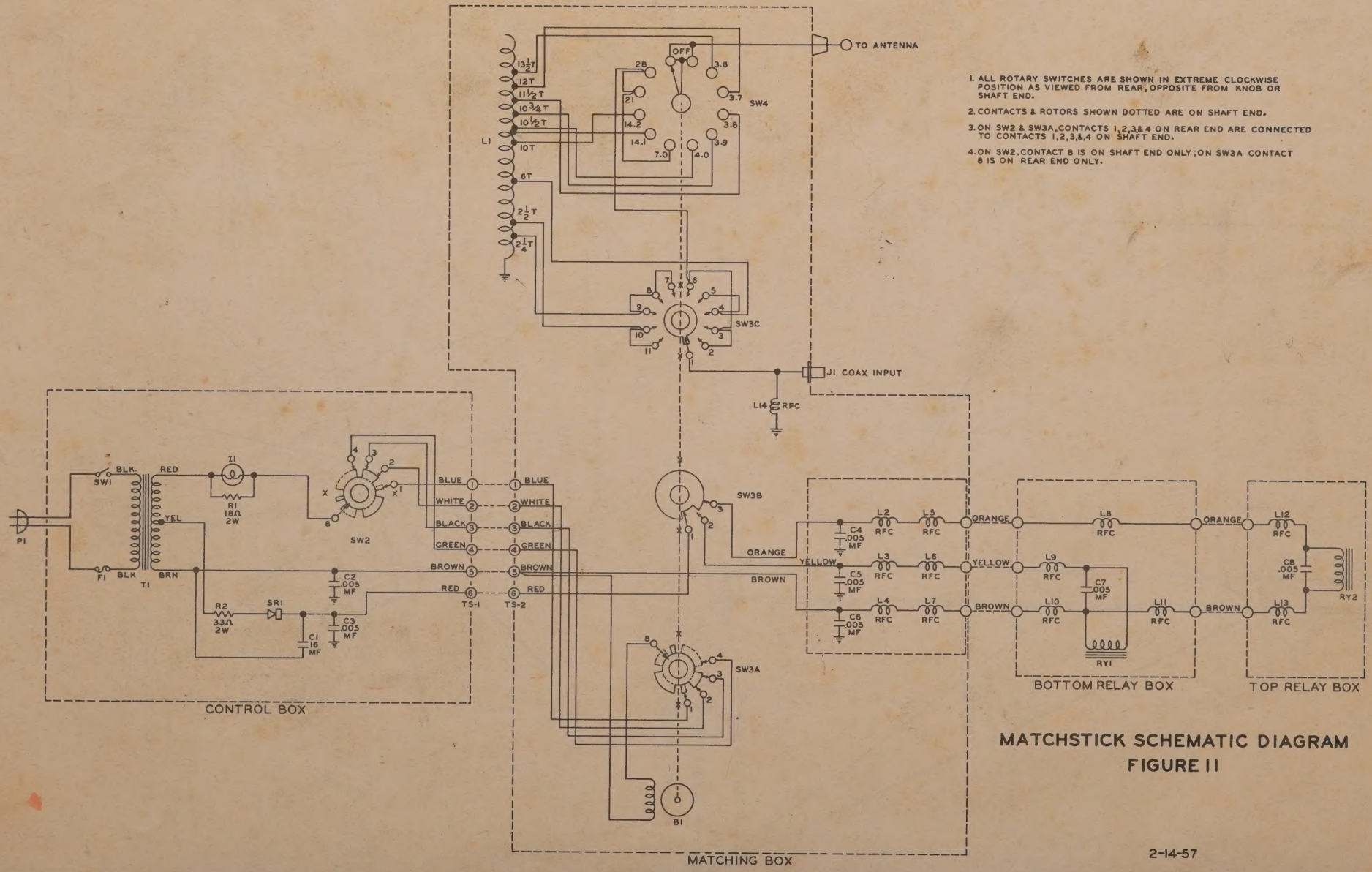




Guy Installation



Radial Installation
Figure 10



1. ALL ROTARY SWITCHES ARE SHOWN IN EXTREME CLOCKWISE POSITION AS VIEWED FROM REAR, OPPOSITE FROM KNOB OR SHAFT END.
2. CONTACTS & ROTORS SHOWN DOTTED ARE ON SHAFT END.
3. ON SW2 & SW3A, CONTACTS 1,2,3,&4 ON REAR END ARE CONNECTED TO CONTACTS 1,2,3,&4 ON SHAFT END.
4. ON SW2, CONTACT 8 IS ON SHAFT END ONLY; ON SW3A CONTACT 8 IS ON REAR END ONLY.

MATCHSTICK SCHEMATIC DIAGRAM
FIGURE 11

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